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ABSTRACT

With current industrial arts/technology teachers aging, and half those in Ohio eligible to retire in 10 years or less, a study was conducted to determine (1) planned retirements and teacher needs of school districts; (2) the number of preservice teacher candidates enrolled in industrial technology programs; and (3) what efforts were being made to attract new and nontraditional students into these teacher education programs. Descriptive data were sought via two questionnaires from 616 public school districts, 59 nonpublic schools that reported industrial technology programs, and 7 teacher education programs in Ohio. Returns were collected from 499 superintendents and 7 teacher education programs. The study showed that the supply of students in teacher education programs in industrial technology (283) was far less than the projected need. In addition, only seven of the students were women. Moreover, less than three-fourths of the graduates from these programs in 1988 sought state teaching certification. Four of the seven teacher education institutions reported that they had increased their efforts to recruit students. At the same time, the survey estimated that 1,023 additional teachers will be required by 1992. The study concluded that teacher education programs will have to make more and better efforts at recruitment and that a national task force should work on averting a crisis. Other recommendations included changes in teacher education programs and re-certification programs for science teachers and others. (KC)

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AN IMPENDING CRISIS:
THE SUPPLY AND DEMAND
OF OHIO INDUSTRIAL TECHNOLOGY TEACHERS
1988 - 1992

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AN IMPENDING CRISIS: THE SUPPLY AND DEMAND OF INDUSTRIAL TECHNOLOGY TEACHERS, 1989-92

A number of studies have suggested that supply and demand conditions in industrial arts/technology (IA/T) education are beginning to change (Devier, 1987; Devier and Wright, 1987; Miller, 1988; and Miller, 1989). Data collected nationally in 1987 indicated an approximate surplus of 70 IA/T teachers, compared to a surplus of 100 the year before (Miller, 1988, 1987).

According to the Eleventh Annual Survey of Industrial Arts Teachers Supply and Demand (Miller, 1989), an equilibrium currently exists, and there appears to be "no surplus and no great need for new teachers". Furthermore, "This condition is destined to change when World War II veterans retire and the Korean War veterans opt to retire at 55 or soon thereafter... Recruitment for undergraduate students is getting difficult."(p 8)

Another aspect of the supply and demand issue is the number of students enrolled in teacher education programs. Enrollment in IA/T teacher education programs has declined significantly during this decade. A recent study indicated that enrollments in Ohio, for example, have dropped from 470 in 1980 to less than half that (220) in 1986 (Devier, 1987).

PROBLEM STATEMENT

Research has indicated that our teaching force is growing steadily older, that many of the younger teachers have been affected by Reduction in Force (RIF) during the past decade, and fewer new teachers are entering our ranks. Specifically, research conducted in 1987 indicated that as many as 24% of the current Industrial Technology teachers will be retiring or eligible for

retirement within five years (1992). Within ten years, just over 50% of the teachers will be retiring or eligible to retire (Devier and Wright, 1987). This information was obtained directly from classroom teachers as part of a study concerned with the status of industrial arts/technology programs in Ohio.

As a result, a research study was conceived to determine (1) specific data for each secondary school district in Ohio regarding personnel issues, such as planned retirements, early buy-outs, teachers needed for curricular expansion of Technology Education in the middle grades, (2) the number of pre-service teacher candidates enrolled in Industrial Technology teacher education programs, and (3) what efforts were being made to attract (recruit) new and non-traditional students into these teacher education programs.

METHOD OF STUDY

Descriptive data were collected via two questionnaires. One, entitled "the Projected Supply and Demand of Industrial Technology Teachers, 1988-1992", was designed to collect data from Ohio school district superintendents to determine the current and future demand for Industrial Technology teachers, and related issues. The second instrument, "The Industrial Technology Teacher Education Student Supply and Demand Questionnaire", was developed to collect data from the seven teacher education programs in Ohio concerning the current and future supply of teachers, and related issues. These instruments are included in the Appendix.

The draft questionnaires were reviewed by an advisory panel of five members representing school districts, teacher education institutions, the Ohio Department of Education, and related

professional associations. Final revisions were made based upon their comments. The data was collected from April - June, 1988.

The population for this study consisted of the superintendents of the 616 public school districts in Ohio and the 59 non-public schools that reported Industrial Technology programs, and the seven colleges and universities that have teacher education programs in Industrial Technology. A total of 499 returns were collected from the superintendents (72.95%) and seven from the teacher education programs (100%).

FINDINGS

Teacher Education Students

Enrollment

The data collected indicated that a total of 283 students were enrolled in programs leading to Industrial Technology teacher certification in Ohio. The numbers were evenly distributed across the four years of school. However, only seven of these 283 students were women (2.5%). Of the 65 graduates from these programs in 1988, only 47 (72%) actually sought certification from the State. The employment status of these 47 graduates with certification is not known at this time. The supply of students in teacher education programs is far less than the anticipated vacancies as reported later in this document.

Recruitment

Four of the seven teacher education institutions reported that they had increased their efforts to recruit students into their programs in the past five years. These efforts were essentially random, and apparently made no significant difference in enrollment.

Future Options

One concern addressed by the questionnaire was related to the possible shortage of industrial technology teachers and how teacher education institutions would respond. Just over one-half of the institutions would respond to a severe shortage with increased recruitment efforts strategically targeted toward both traditional and non-traditional students. In addition, four institutions reported that they would be willing to develop an alternative program to "re-train" college graduates for technology education if a severe shortage should occur. The respondents were also asked what ramifications the addition of technology education as a requirement in the middle school grades would have on their programs. All but one of the institutions indicated that this action would definitely increase the demand for their graduates.

Supply and Demand of Industrial Technology Teachers

Current Supply

The 499 superintendents that responded to this survey represent 72.95% of the population. This study identified 1,516 men and 18 women (1,534 total) reported to actually be teaching industrial arts/technology full-time, and 83 men and 1 woman teaching part-time. The total number of industrial arts/ technology teachers in Ohio was estimated to be 2,200 in 1988 by the Ohio Department of Education. As a result, the districts who responded represented approximately 70% of the estimated number of teachers. This figure was used to project total need for the state in subsequent sections. The variation in district size, with respect to the number of IA/T teachers, ranged from 0 to 130. Districts employing one IA/T teacher were the most frequent (40%).

Faculty Reductions and Turnover

The faculty reductions listed in Table 1 are based on both district level decisions to reduce program offerings and teachers' decisions to voluntarily leave their teaching position. Some of the teachers were reassigned to other areas or responsibilities. Thus, there may be an immediate, short term surplus of certified IA/T teachers is some districts. The teachers voluntarily leaving their positions, for whatever reason, may or may not be replaced.

Table 1 lists the estimated number of teachers that would not be teaching IA/T in 1988-89 for each of several reasons. It was estimated that at least 155 men and 1 woman would not be teaching IA/T in the 1988-89 school year. The most common reasons for not teaching IA/T the following year were related to program cutbacks and declining enrollments (district-level decisions).

Retirements

Projections regarding retirement plans are questionable at best, but essential to facilitate planning. Table 2 lists the projected planned retirement for industrial arts/technology teachers for each of the next four years and the projected number of teachers eligible to retire during this period. As reported by superintendents, 115 (7.5%) teachers have planned to retire over the next four years, while 199 (13%) will be eligible to retire within four years, for a total of 314 (20.5%) potential retirements. If these percentages were projected for the population, we would estimate 158 planned retirements and 273 eligible retirements, for a total of 431 potential retirements by 1992.

Table 1
Estimated Number of Current Teachers That Will Not Be Teaching Industrial Arts/Technology Courses in 1988-89

Reason	Men	Women	Total f	Total %
Enrollment Reductions	34	Ø	34	21.8
Reduction in Force (RIF)	3Ø	Ø	3Ø	19.3
Retirement	29	Ø	29	18.7
Curriculum Revisions	2Ø	Ø	2Ø	12.9
Budget Cutbacks	17	1	18	1Ø.9
Other	1Ø	Ø	1Ø	6.5
Personal Reasons	8	Ø	8	5.3
Dismissal	4	Ø	4	2.7
Disability	3	Ø	3	1.9
Total	155	1	156	1ØØ.Ø

Table 2
Projected Retirement of Industrial Arts/Technology Teachers for 1988-1992

n = 314

Year	Plan to Retire		Eligible to Retire		Total	
	Men	Women	Men	Women	f	%
1987-88	2Ø	Ø	N/A	N/A	2Ø	6.4
1988-89	3Ø	Ø	83	2	115	36.6
1989-9Ø	18	Ø	28	Ø	46	14.6
1990-91	18	2	33	Ø	53	16.9
1991-92	26	1	53	Ø	8Ø	25.5
Total	112	3	197	2	314	1ØØ.Ø

It is interesting to compare these figures reported by superintendents with individual teacher responses reported in "The Status of Industrial Arts/Technology in Ohio Schools -1987" (Devier and Wright, 1987). In that study, 25% of the teachers reported that they would be retiring or eligible for retirement by 1992, as compared to the 20% reported by superintendents in this study. Regardless, a staggering number of teachers are anticipating retirement by 1992.

Additional Teachers Required for Technology Education

Each district was asked how many additional teachers would be needed in their district if technology education were to be mandated as a middle grade requirement in the Minimum Standards for Ohio Schools in 1991-92, as is anticipated. The districts' responses are listed in Table 3. The estimated number of additional teachers required to meet this (possible) mandate would be 424 for the responding districts. If this were generalized to the entire population, an additional 579 teachers would be required statewide. By comparison, 39% of the districts reported that they would not need any additional teachers.

Total Additional Teachers Needed by 1992

An effort was made to project the total number of additional industrial arts/technology teachers that would be required by 1991-92 based upon normal attrition, anticipated retirements, and a mandated technology course in the middle grades. Table 4 lists the total numbers of additional teachers anticipated by the districts. This is not a "worse case scenario", but the superintendents' best guess, given the parameters. It is anticipated that 795 teachers in addition to those currently

Table 3
Number of Additional Industrial Arts/Technology Teachers Required if Technology Education is Required in Middle Grades

n = 473

Number of Teachers	f	%	Total Number of Teachers
0	185	39.1	0
1	215	45.5	215
2	48	10.1	96
3	12	2.5	36
4	4	0.8	16
5	2	0.4	10
6	4	0.8	24
8	1	0.2	8
9	1	0.2	9
10	1	0.2	10
Total			424

Table 4
Anticipated Total Number of Additional
Industrial Arts/Technology Teachers Required by 1991-92

Number of Teachers	f	%	Total Number of Teachers
Ø	133	28.Ø	Ø
1	158	33.3	158
2	94	19.8	188
3	43	9.1	129
4	17	3.6	68
5	12	2.5	6Ø
6	8	1.7	48
7	1	Ø.2	7
8	3	Ø.6	24
9	2	Ø.4	18
1Ø	1	Ø.2	1Ø
12	1	Ø.2	12
13	1	Ø.2	13
6Ø	1	Ø.2	6Ø
Total			795

teaching will be required for the 499 responding districts. If this proportion were projected to the population, an estimated 1,023 additional teachers will be required by 1992.

Familiarity With Program Objectives

The survey instrument was mailed to the superintendent of each school district, and it is likely that in smaller districts it was completed by the superintendent. However, in larger districts it is more likely that the survey was completed by an industrial arts/technology supervisor. Regardless, it was assumed that the responding individual was the district-level person responsible for the IA/T program area. These individuals were asked to rate their familiarity with the philosophy, purpose, and program objectives of technology education, industrial technology, and industrial arts. They were asked to rate their familiarity on a four point Likert scale, with "one" labeled "very familiar" and "four" labeled "not familiar". Their responses are summarized in Table 5.

Approximately 14% (69) of the respondents rated themselves as "very familiar" with the philosophy, purpose, and program objectives of both technology education and industrial technology. By comparison, more than twice as many, 31% (151) rated themselves as "very familiar" with industrial arts program objectives.

Characteristics Sought in New Teachers

Of particular concern to teacher educators and pre-service teacher candidates are the skills, characteristics and traits that superintendents value when hiring new teachers. Each superintendent was asked to rate a list of skills and traits on a scale from one to four, with "one" labeled "most important" and

Table 5
Superintendents'/Supervisors' Familiarity
With Philosophy, Purpose, and Program Objectives

Program	n	Very Familiar 1 f	%	2 f	%	3 f	%	Not Familiar 4 f	%	Mean
Technology Education	485	69	14.2	210	43.3	162	33.4	44	9.1	2.38
Industrial Technology	485	69	14.2	235	48.5	143	29.5	38	7.8	2.31
Industrial Arts	486	151	31.1	251	51.6	66	13.6	18	3.7	1.89

"four" labeled "least important". The ratings for each skill or trait are listed in Table 6. Clearly, the superintendents value "overall educational preparation" the most, followed by "familiarity with the latest curriculum innovations", the "ability to teach a comprehensive technology education course", and "manipulative skills and craftsmanship" respectively.

The characteristics sought in new teachers are listed in Table 6 in rank order according to the mean rating each received. This system gives each district essentially one vote, whether it employs one teacher or one hundred. It follows that large districts that employ more teachers may not necessarily seek the same traits in new teachers as smaller districts. For purposes of analysis, it was decided to calculate a "weighted mean", based upon the number of full-time IA/T teachers employed by the district. The characteristics ranked as the top six were essentially the same. It is interesting to note that several of the weighted means were noticeably lower than the calculated mean. This would suggest that large districts placed more importance on these characteristics than did small districts.

A significant number of "other" responses were received in this section on characteristics sought in new teachers. In total, 12 districts responded that being student centered and the ability to relate to kids, including empathy, was very important. Seven districts listed comments related to professional education skills, classroom management skills, organization, and safety consciousness. Five districts listed comments related to being personable and cooperative.

Table 6
Superintendents' Ratings of Various Characteristics Sought in New Teachers

Characteristics	n	Most important 1 f	1 %	2 f	2 %	3 f	3 %	Least important 4 f	4 %	Mean	*Weighted Mean
Overall educational preparation	481	260	54.1	203	42.2	15	3.1	3	0.6	1.50	1.40
Familiarity with or knowledge of latest curriculum innovations	474	216	45.6	228	48.1	28	5.9	2	0.4	1.61	1.50
Ability to teach comprehensive technology education course	478	220	46.0	218	45.6	39	8.2	1	0.2	1.63	1.49
Manipulative skills/craftmanship	465	159	34.2	271	58.3	35	7.5	0	0.0	1.73	1.74
Ability to teach more than 1 curricular area	477	190	39.8	169	35.4	91	19.1	27	5.7	1.91	1.86
Math/Science aptitude and ability to apply in a lab setting	475	108	22.7	296	62.3	66	13.9	5	1.1	1.93	1.91
K-12 teaching certificate	471	94	20.0	165	35.0	142	30.1	70	14.9	2.40	2.33
Ability to coach	473	24	5.1	118	24.9	194	41.0	137	29.0	2.94	3.05
Experience with student organizations (AIASA)	468	17	3.6	106	22.6	213	45.5	132	28.2	2.98	2.83
Special education endorsement	443	15	3.4	102	23.0	193	43.6	133	30.0	3.00	2.71
Minority/ethnic background	468	20	4.3	88	18.8	164	35.0	196	41.9	3.15	2.63
Female	461	8	1.7	64	13.9	188	40.8	201	43.6	3.26	2.94

* Weighted by number of IA/T teachers in district

CONCLUSIONS AND RECOMMENDATIONS

The researchers offer the following conclusions and recommendations based upon the data collected as part of this study, conversations with the advisory board, and state and national trends.

1. Teacher education programs will have to make much greater efforts in the area of recruitment. These efforts will have to be more coordinated and focused than past practices have been. In addition, recruitment efforts should also be directed toward non-traditional students; including women, minorities, and students with a keen interest in applied science, in addition to the (previously) typical "craftsman" type of individual.
2. There appears to be sufficient evidence to suggest that a crisis is pending. However, the situation is not hopeless IF WE TAKE ACTION NOW. Specific activities need to be identified to attract qualified teachers for technology education. A task force should be developed at the national level to formulate a strategic plan. The alternative, should we decide to take no action, is to watch more and more programs be eliminated as current teachers retire. If we have not prepared qualified teachers for technology education, and more states begin to mandate required courses, some other discipline will step in to fill the void.
3. School districts may need to encourage science or other teachers to obtain dual certification with technology education if a severe shortage of technology teachers should develop.

4. State departments of education need to review the certification requirements for technology teachers. There is currently a wide range among what universities teach, state certification requirements, and what high schools offer. Students cannot be trained in woodworking, mechanical drawing, etc. and then asked to teach communication technology or manufacturing technology. Conversely, we cannot train students in CAD/CAM and expect them to meet certification standards if the requirements list "industrial crafts", or to teach basic forging and sheet metalwork in high schools. More coordination is needed among secondary schools, certification officers, and university faculty.
5. Teacher education institutions may need to develop special programs to "re-train" teachers from other disciplines, or individuals with degrees in related areas if a severe shortage should occur.
6. Further research needs to be conducted to determine why only 72% of those students in teacher education programs actually seek certification, and of these, how many actually accept teaching positions.
7. A mentoring network should be developed to support women teachers in IA/T. These individuals could be instrumental in recruitment efforts to increase the number of non-traditional teachers in the field.
8. There is ample evidence to suggest that a crisis is pending. If we desire qualified teachers and sound educational programs, we, as professionals, need to plan and take action now.

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